ASSIGNMENT 3

Textbook Assignment: Unit 2, Lesson 1, "Properties of Sound." Page 2-1-1 through 2-1-13.
Unit 2, Lesson 2, "Sound Propagation in Seawater." Pages 2-2-1 through 2-2-10.
Unit 3, Lesson 1, "Satellite Imagery of Oceanographic Features." Pages 3-1-1 through 3-1-18.
Unit 4, Lesson 1, "FLENUMOCEANCEN'S Analysis Models." Pages 4-1-1 through 4-1-4.

Learning Objective:
Recognize the three basic elements necessary for the production of sound.

3-1. Which of the following is a sound source?

1. A vibrating metal rod
2. A metal rod at rest
3. A radio speaker without electric current
4. A bell that has not been struck

3-2. Which of the following is NOT a medium for sound propagation?

1. Air
2. Water
3. Vacuum
4. A steel rod

3-3. In which of the following mediums would sound travel the fastest?

1. Air
2. Water
3. Vacuum
4. A steel rod

3-4. The approximate speed of sound in air at 15°C is how many meters per second?

1. 340.5
2. 332.1
3. 331.5
4. 322.5

3-5. In which of the following mediums is the speed of sound the greatest?

1. Air at 15°C
2. Freshwater at 15°C
3. Saltwater at 0°C
4. Saltwater at 15°C

3-6. An ear and a hydrophore are examples of a sound

1. source
2. medium
3. receiver
4. absorber

Learning Objective:
Identify the various properties of sound waves.

3-7. Which of the following definitions best describes wavelength of a sound wave?

1. The distance from one wave crest to the following wave trough
2. The distance from a wave crest to the following wave crest
3. The distance from a wave compression to the following wave rarefraction
4. The distance from a wave compression to the following wave compression

A. FREQUENCY
B. HERTZ
C. WAVELENGTH
D. PITCH

FIGURE 3A

IN ANSWERING QUESTIONS 3-8 THROUGH 3-11, CHOSE THE TERM FROM FIGURE 3A THAT MATCHES THE DEFINITION GIVEN AS THE QUESTION. TERMS ARE USED ONLY ONCE.

3-8. Number of cycles per second.

1. A
2. B
3. C
4. D

3-9. Frequency of sound received at the detector.

1. A
2. B
3. C
4. D

3-10. One cycle per second.

1. A
2. B
3. C
4. D

3-11. Distance between two successive compressions or refractions.

1. A
2. B
3. C
4. D

3-12. What is a measurement of a sound wave's energy in decibels called?

1. Loudness
2. Power
3. Strength
4. Intensity

Learning Objective: Define spreading loss as it pertains to sound waves.

3-13. Which of the following definitions best describes the cause of spreading loss (the loss of energy per unit area as distance increases from the source)?

1. Normal propagation spreads the energy over an increasingly larger area
2. Friction decreases the energy
3. Refraction spreads the energy over a larger area
4. Reflection causes some energy to return to the source

Learning Objective: Define Doppler effect and recognize how it affects the pitch and frequency of sound.

3-14. Which of the following definitions best describes Doppler effect on sound?

1. An apparent change in pitch of the sound wave due to movement of the source
2. An apparent change in sound wave speed due to movement of the source
3. An apparent change in sound wave intensity due to the source moving closer or further away from the receiver
4. An apparent change in sound wave direction due to movement of the source

3-15. When a sound source is approaching a receiver, the Doppler effect causes the sound pitch to

1. decrease as the received sound waves are compressed
2. increase as the received sound waves are compressed
3. decrease as the received sound waves are stretched out
4. increase as the received sound waves are stretched out

Learning Objective: Define sound velocity and describe the effect of temperature, pressure, and salinity on sound.

3-16. What is the most important controller of the speed of sound?

1. Temperature
2. Salinity
3. Pressure
4. Depth (or elevation)

3-17. The increase or decrease in the speed of sound with changing temperatures is dependent on the temperature. The approximate change in the speed of sound in seawater per 1°C increase in temperature is how many meters per second?

1. +2.4
2. -2.4
3. +1.7
4. -1.7

3-18. What is the second most important controller of the speed of sound in seawater?

1. Temperature
2. Salinity
3. Pressure
4. Depth

3-19. The approximate change in the speed of sound in seawater per 100 meter increase in depth is how many meters per second?

1. +2.4
2. -2.4
3. +1.7
4. -1.7

3-20. What is the third most important controller of the speed of sound in seawater?

1. Temperature
2. Salinity
3. Pressure
4. Depth

3-21. The change in the speed of sound in seawater for a 1 part per thousand increase in salinity is how many meters per second?

1. -1.7
2. +1.7
3. -1.4
4. +1.4

3-22. What is the “sonic layer depth”?

1. Depth of maximum pressure
2. Depth of maximum sound speed
3. Depth of maximum temperature
4. Depth of maximum density

3-23. In warm seawater (17 to 18°C), which of the following thermal gradients could result in an isovelocity layer on a SVP?

1. -0.1°C per 30 meters
2. -0.2°C per 30 meters
3. -0.5°C per 30 meters
4. -0.6°C per 30 meters

An evaluation of a BT trace yields the following information:

- **SST - 18.0°C**
- **Shallow layer "A" 30 meters thick - gradient -0.4°C/30 meters**
- **Deeper layer "B" 150 meters thick - gradient -1.0°C/30 meters**
- **Deepest layer "C" 180 meters thick - gradient +0.0°C/30 meters**

FIGURE 3B

REFER TO FIGURE 3B TO ANSWER QUESTIONS 3-24 AND 3-25.

3-24. Where is the SLD located?

1. At the surface
2. Between layers A and B
3. Between layers B and C
4. At the bottom of layer C

3-25. Reevaluation of the BT data in figure 3B yields a corrected gradient for layer “A” of -0.10°C per 30 meters. Now where would the SLD be located?

1. At the surface
2. Between layers A and B
3. Between layers B and C
4. At the bottom of layer C

3-26. In a Sonar Range Prediction message, what does the term “in layer” mean?

1. A sonar range in the layer of water within 50 feet of the SLD
2. A sonar range in the layer of water below the SLD
3. A sonar range in the layer of water between the SLD and the MLD
4. A sonar range in the layer of water from the surface to the SLD

Learning Objectives:
Explain why sound propagates along more or less curved paths, and describe the five basic sound ray patterns along with their attendant temperatures and sound velocity profiles.

3-27. Which law states that sound waves are refracted toward the region of slower sound speed?

1. Boyle’s Law
2. Snell’s Law
3. Pascal’s Theorem
4. Newton’s First Law

3-28. If a layer of water With an isovelocity gradient overlies a layer of water with a positive sound velocity gradient, in what manner will sound produced in the isovelocity-gradient layer behave?

1. It will curve downward in the isovelocity layer then propagate in a straight line through the positive-gradient layer
2. It will curve upward in the isovelocity layer, then propagate in a straight line through the positive-gradient layer
3. It will propagate in a straight line through the isovelocity layer, then curve downward through the positive-gradient layer
4. It will Propagate in a straight line through the isovelocity layer, then curve upward through the positive-gradient layer

3-29. Which of the following sound velocity conditions will produce a split-beam pattern?

1. Positive overlying negative
2. Isovelocity overlying negative
3. Both 1 and 2 above
4. Negative overlying positive

3-30. Which of the following sound velocity conditions will produce a sound channel?

1. Negative overlying positive
2. Positive overlying negative
3. Isovelocity overlying positive
4. Isovelocity overlying negative

3-31. Which of the following ocean bottom types is the best reflector of sound?

1. Rippled sand
2. Smooth sand
3. Rock boulders
4. Mud/ooze

3-32. Which of the following ocean bottom types scatters sound energy the most?

1. Rippled sand
2. Smooth sand
3. Rock boulders
4. Mud/ooze

3-33. With increasing winds, which of the following wind speeds will first produce the highest surface reverberation level?

1. 05 kt
2. 10 kt
3. 20 kt
4. 25 kt

3-34. What type of reverberation do shrimp produce?

1. Surface
2. Volume
3. Bottom

3-35. In which of the following layers would the deep scattering layer most likely be found in the tropics?

1. Surface to 100 fathoms
2. 100 to 400 fathoms
3. 400 to 800 fathoms
4. 800 to 1,500 fathoms

3-36. When the ocean bottom is composed of a soft mud layer overlying hard sand overlying a rough rock layer, which of the following processes would likely occur?

1. Bottom reverberation
2. Reflection
3. Absorption
4. All of the above

3-37. Which of the following sound velocity profiles would be most favorable for a surface ship conducting antisubmarine warfare operations?

1. Positive gradient overlying negative gradient
2. Positive gradient
3. Negative gradient
4. Isovelocity gradient

3-38. Which of the following sound velocity profiles would be most favorable for a submarine conducting antiship operations at periscope depth?

1. Strong negative gradient
2. Strong positive gradient
3. Weak negative gradient
4. Isovelocity gradient

3-39. Which of the following is a correct description of the term “attenuation”?

1. Scattering of sound energy
2. Absorption of sound energy
3. Reflection of sound energy
4. Loss of energy during propagation

Learning Objective: Differentiate between active and passive sonar, define the modes of active sonar search, and describe the propagation paths used in each mode.

3-40. Which of the following modes of sonar operation detects objects by listening for sound generated by the object?

1. Passive
2. Active - deep water
3. Active - shallow water
4. Each of the above

3-41. In shallow water during active sonar operations, which types of transmission paths are most effectively used to detect an object?

1. Direct path and bottom bounce
2. Direct path and surface duct
3. Bottom bounce and surface duct
4. Convergence zone and bottom bounce

3-42. What type of transmission path is formed when the temperature increases with depth?

1. Bottom bounce
2. Sound channel
3. Surface duct
4. Direct path

3-43. In shallow water, what environmental factor affects the success of active sonar operations to the greatest degree?

1. Water depth
2. Temperature gradients
3. Sea state
4. Bottom type

3-44. Where is the deep-sound-channel axes usually located in the Atlantic Ocean?

1. At any depth down to 700 fathoms (4,200 feet/1,280 meters)
2. At the MLD
3. At the depth where the overall temperature gradient changes from negative to isothermal - the base of the main thermocline
4. At the top of the main thermocline

3-45. In deep water, what sound velocity condition must be present for convergence zone transmissions to occur?

1. Positive gradient
2. Negative gradient
3. Negative gradient overlying positive gradient
4. Positive gradient overlying negative gradient

Learning Objective: Define and differentiate between the elements used in the active and passive sonar equations.

3-46. Which of the following values, when equal to zero decibels, yields a 50 percent detection probability?

1. Signal excess
2. Target strength
3. Noise level
4. Reverberation level

3-47. Which element of the active sonar equation accounts for target size, shape, and type of construction material?

1. Source level
2. Recognition differential
3. Target strength
4. Noise level

3-48. Which element of the active sonar equation changes with the sea state and ship’s speed?

1. Recognition level
2. Target strength
3. Propagation loss
4. Noise level

3-49. Which of the following values is NOT of major importance to passive sonar?

1. Noise level
2. Target strength
3. Propagation loss
4. Signal excess

Learning Objective:
Differentiate between permanent and transient oceanic fronts, and recognize the differences that occur across frontal boundaries.

3-50. Where are oceanic fronts usually found?

1. Over major suboceanic ridges
2. At the boundaries of surface currents
3. Under the surface position of atmospheric fronts
4. Between any different water masses

3-51. A “permanent” oceanic front, as opposed to a “transient” oceanic front, exhibits which of the following characteristics?

1. It may be observed in the same general location for several months
2. Its slow movement across large areas of the ocean may be observed in satellite imagery
3. It is usually found in the same general location during all seasons
4. It may form and dissipate in a period of several weeks

3-52. Due to the salinity changes, an oceanic front found near the mouth of a large river may always be classified as what type of front?

1. Haline
2. Thermal
3. Turbidity
4. Density

3-53. Which characteristic of ocean fronts may be determined using infrared satellite imagery?

1. Water color contrast
2. Wave height differences
3. Hal ne contrast
4. Thermal contrast

3-54. Which characteristic of oceanic fronts may sometimes be determined from a visible satellite image sunglint area?

1. Wave height differences
2. Haline contrast
3. Thermal contrast
4. Biological population density

Learning Objective:
Identify the two types of oceanic eddies and the type of satellite imagery used to locate and identify them.

3-55. What circulation and temperature patterns are usually found within a cold-core eddy?

1. Anti-cyclonic rotation and temperature increases outward from the center
2. Anti-cyclonic rotation and temperature decreases outward from the center
3. Cyclonic rotation and temperature increases outward from the center
4. Cyclonic rotation and temperature decreases outward from the center

3-56. How are ocean eddies best identified?

1. Analysis of SST from ship reports
2. Analysis of XBT reports
3. Analysis of IR satellite imagery
4. Analysis of VIS satellite imagery

3-57. What is the normal size range of ocean eddies?

1. 0 - 1 mi
2. 1 - 10 mi
3. 10 - 100 mi
4. 100 - 1,000 mi

3-58. Ocean eddies modify the surface weather. What conditions may be expected within a cold eddy as opposed to outside the eddy?

1. Winds stronger, seas higher, less cumulus cloud development
2. Winds stronger, seas higher, increased cumulus cloud development
3. Winds lighter, seas lower, less cumulus cloud development
4. Winds lighter, seas lower, increased cumulus cloud development

3-59. In a black and white IR satellite image with a standard linear enhancement, black shows the warmest temperatures and white shows the coldest temperatures. How are warm eddies identified on an IR image?

1. They appear as circular areas of darker gray shades surrounded by lighter shades
2. They appear as circular areas of lighter gray shades surrounded by darker shades
3. They appear as a black circular area surrounded by white
4. They appear as a white circular area surrounded by black

Learning Objective:
Identify the observable characteristics of upwelling, internal waves, and sea ice.

3-60. How is upwelling usually identified on an IR satellite image?

1. As a pocket of gray shades lighter than the surrounding water, oriented along a coastline
2. As a pocket of gray shades darker than the surrounding water, oriented along a coastline
3. As a pocket showing a banded pattern of light and dark gray shades, oriented along a coastline
4. As a pocket with gray shades lighter than the surrounding water, located approximately over the edge of the continental shelf

3-61. How can internal waves be located or identified?

1. As a rough area on visible satellite imagery
2. As a large, bright area on visible satellite imagery
3. As a series of concentric, alternating dark and light gray shade bands on an IR satellite image
4. As a series of dark bands in a sunglint area of a visible satellite image

3-62. How is sea ice with leads observable in visible satellite imagery?

1. As a grainy white field with darker fracture lines that doesn’t move much from day to day
2. As a clear. brilliant white area with darker fracture lines that doesn’t move much from day to day
3. As a lighter shade of gray than the surrounding open water, with slightly darker fracture lines throughout
4. As a darker shade of gray than the surrounding open water, with slightly lighter fracture lines throughout

Learning Objective:
Recognize the impact of grid point spacing on computer generated analyses, and identify the parameters and the analysis technique used in FLENUMOCEANCEN'S surface analysis model.

3-63. What does a "fine mesh" grid point spacing indicate?

1. Spacing between grid points is 320 kilometers
2. The grid field measures 63 points by 63 points
3. The computer preforms less calculations to develop the finished product
4. Using the same raw information, the product completed on a fine mesh grid is more accurate than a product completed on a coarse mesh grid

3-64. In the computer analysis technique known as "FIB", what does "FIB" represent?

1. Forecast Interpretive Balance
2. Fields by Information Blending
3. Forecast Information Bank
4. Field Interrogative Back-feed

3-65. Where does "FIB" get its first guess fields?

1. The previous data cycle's analyses and forecasts only
2. Climatology only
3. The previous data cycle's analyses and forecasts, and climatology
4. An initial analysis of current data coupled with a climatological field

3-66. What are "bogus" reports?

1. False reports intentionally submitted by non-friendly forces to introduce errors into our computer products
2. False reports inadvertently submitted by friendly ships and land stations, that cause errors in our computer products
3. Intentional false reports submitted by Naval Oceanography Command personnel to guide the computer to correct errors in its products
4. Any unverifiable report submitted by unknown or unreliable sources

3-67. What occurs during the blending process?

1. Grid points initialized by first guess fields are adjusted using actual reported data values
2. Grid points initialized by first guess fields are replaced using actual reported data values
3. Multiple first guess fields are averaged to form one analysis field data on the grid
4. An initial analysis of current data is averaged with the first guess field

3-68. A major problem with FIB is that an accurate report from an area of rapidly developing weather may be rejected if it doesn't fit the preestablished error range.

1. True
2. False

3-69. The Optimum Interpretation technique is expected to replace FIB sometime in the early 1990's.

1. True
2. False

Learning Objective: Name the models used to analyze upper air data and recognize why the primary program is run every 6 hours.

3-70. What is the primary program used to analyze upper-air data?

1. NOGAPS
2. NORAPS
3. FIB
4. PE

3-71. Why is the primary model run every 6 hours?

1. The fleet needs the upper-air data from every synoptic collection
2. The upper-air situation can change dramatically between standard synoptic collections
3. The model is still undergoing evaluation and produces such large errors from time to time that it must be reinitialized every 6 hours
4. Upper-air data is sparse; running the model every 6 hours allows all available data to be used to adjust the models output for more accurate results

3-72. Which model is used for tropical upper-air analysis?

1. NOGAPS
2. NORAPS
3. Global Bands (GB)
4. Southern Hemisphere Polar Stereographic analysis

3-73. What model is used to analyze the Southern Hemisphere upper-air situation?

1. Standard NOGAPS
2. Standard NORAPS
3. Standard GB
4. NOGAPS modified to rely more on satellite data